WHAT IS CLAIMED IS:

1. A nanostructure comprising:

a substrate having a surface containing at least one material selected from the group consisting of semiconductors, noble metals, Mn, Fe, Co, Ni, Cu and carbon; and

an anodized film disposed on the surface of said substrate, said anodized film having a nanohole,

wherein said nanohole passes through said anodized film from the surface of said anodized film to the surface of said substrate, and said nanohole has a first diameter at the surface of said anodized film, and a second diameter at the surface of said substrate, and wherein said nanohole has a constriction at a location between the surface of said anodized film and the surface of said substrate, said constriction having a diameter smaller than said first and second diameters.

2. A nanostructure comprising:

a substrate having a surface containing at least one material selected from the group consisting of semiconductors, noble metals, Mn, Fe, Co, Ni, Cu and carbon; and

an anodized film disposed on the surface of said

substrate, said anodized film having a nanohole,

wherein said nanohole passes through said anodized film from the surface of said anodized film to the surface of said substrate, and said nanohole has a first diameter at the surface of said anodized film, and a second diameter at the surface of said substrate, and wherein said second diameter is greater than said first diameter.

3. A nanostructure according to Claim 1 or 2, wherein the surface of said substrate is formed of a semiconductor oxide.

4. A nanostructure according to Claim 3, wherein the surface of said substrate is porous.

5. A nanostructure according to Claim 1 or 2, wherein the semiconductor is Si.

6. A nanostructure according to Claim 1 or 2, wherein the noble metal is selected from the group consisting of Ag, Au, Pt, Pd, Ir, Rh, Os and Ru.

7. A nanostructure according to Claim 1 or 2, wherein the carbon is selected from the group consisting

of graphite, glassy carbon and amorphous carbon.

8. A nanostructure according to Claim 1 or 2, wherein an inclusion is embedded in said nanohole.

9. A nanostructure according to Claim 1 or 2, wherein said anodized film has an additional nanohole and the surface of said substrate includes first and second regions which are different in characteristic.

10. A nanostructure according to Claim 9, wherein the characteristic is resistance.

11. A nanostructure according to Claim 9, wherein an inclusion is embedded only in the nanohole located on said first region.

12. A nanostructure according to Claim 9, wherein said first region is an n-type semiconductor region and said second region is a p-type semiconductor region.

13. A nanostructure according to Claim 9, wherein said first region is an electrically conductive region and said second region is an electrically insulating region.

14. A nanostructure according to Claim 13, wherein said first region is a semiconductor region.

15. A nanostructure according to Claim 14, wherein said semiconductor region is an n-type semiconductor region.

16. A nanostructure according to Claim 8, wherein said inclusion is a magnetic material.

17. A nanostructure according to Claim 16, wherein said magnetic material includes a ferromagnetic material and a non-magnetic material which are multilayered.

18. A nanostructure according to Claim 8, wherein a substance having a capability of emitting light is embedded in said nanohole.

19. A nanostructure according to Claim 18, wherein said substance having the capability of emitting light is a substance having a capability of emitting light by means of fluorescence.

20. A nanostructure according to Claim 8, wherein a substance having a carrier type opposite to that of the

semiconductor forming the surface of said semiconductor is embedded in the nanoholes.

21. A nanostructure according to Claim 8, wherein the anodized film comprises aluminum oxide, and a substance having a dielectric constant different from that of the aluminum oxide is embedded in the nanohole.

22. A nanostructure according to Claim 8, wherein a carbon nanotube is embedded in the nanohole such that one end of said carbon nanotube is connected to the surface of said substrate.

23. A nanostructure according to Claim 8, wherein:

said substrate includes an n-type semiconductor surface region located under the nanohole; and

a carbon nanotube is embedded in the nanohole located on the n-type semiconductor region, with one end of said carbon nanotube is connected to the surface of said n-type semiconductor.

24. An electron emitting device comprising:

a nanostructure comprising a substrate having a surface containing at least one material selected from the group consisting of semiconductors, noble metals, Mn,

Fe, Co, Ni, Cu and carbon, and an anodized film disposed on the surface of said substrate, said anodized film having a nanohole, a carbon nanotube which is embedded in the nanohole such that one end of said carbon nanotube is connected to the surface of said substrate; said nanohole passing through said anodized film from the surface of said anodized film to the surface of said substrate, wherein said nanohole has a first diameter at the surface of said anodized film, and a second diameter at the surface of said substrate, and wherein said nanohole has a constriction having a diameter smaller than said first and second diameters; at a location between the surface of said anodized film and the surface of said substrate,

an electrode disposed such that said electrode and the surface of said substrate face each other; and

means for applying a voltage between the surface of said substrate and said electrode.

25. An electron emitting device comprising:

a nanostructure comprising a substrate having a surface containing at least one material selected from the group consisting of semiconductors, noble metals, Mn, Fe, Co, Ni, Cu and carbon, and an anodized film disposed on the surface of said substrate, said anodized film having a nanohole, a carbon nanotube which is embedded in

the nanohole such that one end of said carbon nanotube is connected to the surface of said substrate; said nanohole passing through said anodized film from the surface of said anodized film to the surface of said substrate, wherein said nanohole has a first diameter at the surface of said anodized film, and a second diameter at the surface of said substrate, and wherein said second diameter is greater than said first diameter;

an electrode disposed such that said electrode and the surface of said substrate face each other; and

means for applying a voltage between the surface of said substrate and said electrode.

26. A method of producing a nanostructure comprising an anodized film including a nanohole on a substrate having a surface containing at least one material selected from the group consisting of semiconductors, noble metals, Mn, Fe, Co, Ni, Cu and carbon, said nanoholes passing through said anodized film from the surface of said anodized film to the surface of said substrate, wherein said method comprising the steps of:

(i) forming a film containing aluminum on the substrate having a surface containing at least one material selected from the group consisting of

semiconductors, noble metals, Mn, Fe, Co, Ni, Cu and carbon; and

(ii) anodizing said film containing aluminum, wherein in step (ii) the anodization is conducted while monitoring an anodization current and the anodization of said film containing aluminum terminates when a reduction in said anodization current from a steady-state value is detected.

27. A method of producing a nanostructure according to Claim 26, wherein the anodization terminates when the anodization current is decreased from the steady-state value to 95% or below of the steady-state value.

28. A method of producing a nanostructure according to Claim 26, wherein an anodization voltage applied to said film including aluminum is supplied from the substrate side.

29. A method of producing a nanostructure according to Claim 26, further comprising the step of expanding the diameter of the nanoholes by means of etching, after completion of said anodizing step.

30. A method of producing a nanostructure according

to Claim 26, further comprising the step of forming an anodization starting point on the surface of said film including aluminum prior to said anodizing step.

31. A method of producing a nanostructure according to Claim 30, wherein a recessed portion serving as said anodization starting point is formed on said film including aluminum prior to said anodizing step.

32. A method of producing a nanostructure according to Claim 26, further comprising the step of embedding an inclusion into said aluminum oxide nanoholes after said anodizing step.

33. A method of producing a nanostructure according to Claim 32, wherein the embedding of the inclusion is performed by means of electro-deposition.

34. A method of producing a nanostructure according to Claim 33, wherein the surface of said substrate includes a high-resistance part, and wherein said method further comprises the step of converting said surface at the bottom of the nanohole into a low-resistance surface prior to the electro-deposition.

35. A method of producing a nanostructure according to Claim 34, wherein the surface of said substrate includes a silicon oxide and said surface is etched with an aqueous solution containing hydrofluoric acid or an alkaline aqueous solution.

36. A method of producing a carbon nanotube device, comprising the steps of:

forming a film including aluminum on a substrate having a surface including an n-type semiconductor region;

anodizing said film including aluminum over the entire thickness thereof so as to form an anodized film having a nanohole;

electro-depositing a catalytic fine particle on the surface at the bottom of said nanohole; and

growing carbon nanotubes from said catalytic fine particle in the nanohole.